CS 731 Example Exam 2

November 15, 2000

Part I: Short Answer (8 pts each)

1. A clique tree is a *junction tree* if and only if it satisfies what property?

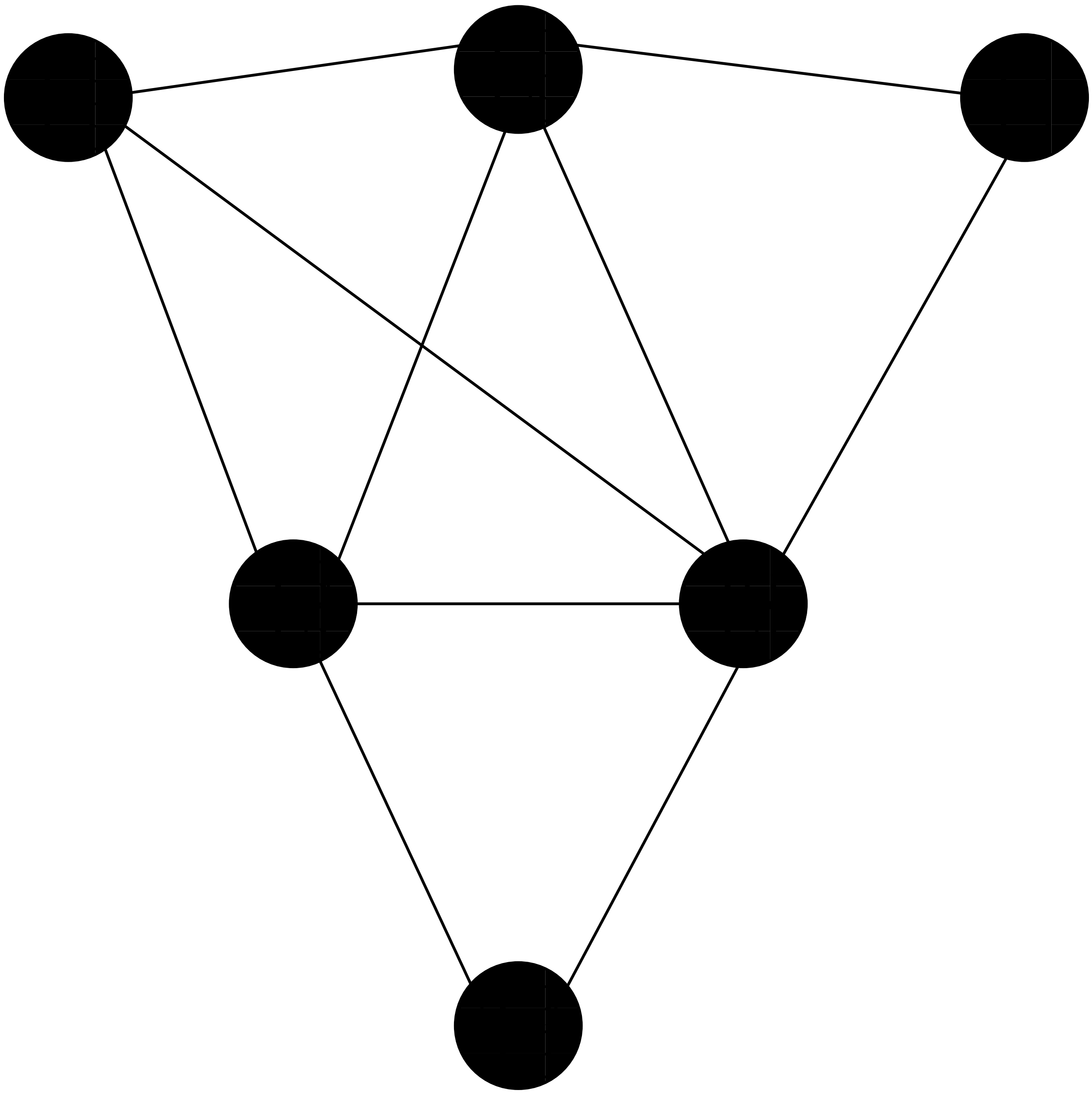
2. Propositions A and B are *independent* if and only if:

3. Propositions A and B are independent *given* C (*conditionally independent*) if and only if:

4. Let $\langle X_1, ..., X_n \rangle$ be a total ordering of the variables in a Bayes Net, where for all $1 \leq i \leq n$ all the members of $Pa(X_i)$ appear before X_i in this ordering. The following defines the semantics of the Bayes Net.

5. The *Markov Blanket* of a variable X within a Bayes Net consists of exactly the:

Part II (20 points): Is the following graph triangulated? Support your answer by numbering the nodes according to MaximumCardinalitySearch. If this fails, circle the first offending node (and/or draw a missing edge).



Part III (20 points): Consider the "Smoking" Bayes Net from the Lecture Notes. Suppose we know a person is a smoker but we have no other observations. Calculate the probability this person has shortness of breath (answer the query $\mathbf{P}(\mathit{ShortnessOfBreath} \mid \mathit{Smoking}{=}\mathit{true})$) using *Variable Elimination*. **Eliminate** *Smoking*, **then** *HeartDisease*, **then** *LungDisease*.

Part IV (20 points): Consider again the "Smoking" Bayes Net. Suppose we know this person is a smoker and has heart disease. Estimate the probability that this person has shortness of breath using Gibbs sampling with the following sequence of random numbers: $0.124, 0.474, 0.394, 0.949, 0.738, 0.213, 0.894, 0.021$**. Use an initial setting of all variables to** *true* **and no burn-in phase. Choose to sample** *LungDisease* **next if the next random number is less than 0.5, and otherwise choose to sample** *ShortnessOfBreath***.**